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MACHINE GUN PRACTICE AND TACTICS

M. KELLAR

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Drill and tactics.

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MACHINE GUN PRACTICE AND TACTICS

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MACHINE GUN PRACTICE AND TACTICS

FOR

OFFICERS, N. C. O's AND MEN

BY

LIEUT. K. B. McKELLAR

Canadian Machine Gun Service

NEW YORK PUBLIC LIBRARY

New York

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1917

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NOTE

The methods of Organization and Machine Gun Units and the sequence of training set forth in this book are those that have been accepted for instructional purposes as a result of the experience of the last three years. The book is written out of the experience of the author at the front and in instructing men for active service in the present war.

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PRACTICE AND TACTICS

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MACHINE GUN PRACTICE AND TACTICS

CHAPTER I

OBJECTS AND OUTLINE OF TRAINING

1. Differentiate between training in Machine Gun and Automatic Rifle (latter is branch of Infantry).

2. **OBJECTS OF COURSE.**

A. **Mechanical Training** — Thorough knowledge of gun and accessories, including proper sequence of instruction, with special attention to "Stoppages" and remedies thereof.

Under this head —

(a) General description and names of parts.

(b) Action of Mechanism.

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(c) Stripping — Proper sequence.
(d) Changing parts — Spare Parts.
(e) Care and Cleaning.
(f) Stoppages — Immediate Action.
Causes.
Remedies.
Prevention.
(g) Points before, during and after firing.
(h) Belt filling by machine and hand.
(i) Tests in above.

B. Drill — Necessary so that men will perform duties instinctively when in action. Object — to teach quickest and best method of doing things without unnecessary movement.

Divided into —

1. Elementary — Including Tests of Elementary Training.
2. Advanced — Carrying and dragging gun and tripod, creeping, crawling over all sorts of ground, occupation of positions, etc.
3. Signals and Semaphore.

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4. Machine Gun Company and Section Drill — with and without transport.

C. Firing on the range.

(a) *25 yd. range.*
Holding.
Grouping.
Application.
Traversing.
Vertical Searching.
Correction of Stoppages.

(b) *Long Range.*
Ranging — 400 yds.
Application — 400 yds.
Traversing — 400 yds.
Observation — about 1000 yds.
Action practices — 600 yds. to 200 yds.
Total about 300 rounds per man.

D. Fire Direction and Control.

1. Visual Training and Judging Distance.
2. Indication and Recognition of Targets.
3. Different kinds of fire, when and how to apply them.

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4. Fire Orders and Signals — Proper sequence of giving and method of passing.
5. Ranging and preparation of Range Cards.

E. General Theoretical.

1. Organization and Equipment.
2. Allocation of Duties.
3. Characteristics.
4. Tactics.
5. Machine Gun Map Work.

F. Tactical.

(a) *Open Warfare.*

Principles of use of Machine Guns in action — attack and defense.
Advanced Guard, Rear Guard and Village Fighting.
Reconnaisance and Study of Ground.
Choice of gun and alternative positions.
Occupation of Positions — bringing up guns.
Coöperation between Guns and with Other Troops.
Methods of Communication.

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Position and Movements of Limbers.
Ammunition Supply.
Tactical Exercises.

(b) *Trench Warfare.*
Attack.
Defense — Trench systems.
Machine Gun Emplacements and Field Works.
Taking over Trenches and Trench Discipline.
Ammunition Supply.

(c) *Battle Actions.*
Lectures and practical work on above.

3. METHODS OF INSTRUCTION.

Lectures, demonstrations and practical work combined. Instructors are responsible for their groups — will instruct on lines laid down — sequence of instruction in each case to be especially noted.

4. SUPPLEMENTARY TRAINING FOR MACHINE GUNNERS.

1. Automatic Rifle.

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2. Bombing.
3. Bayonet Fighting.
4. Entrenching.

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CHAPTER II

ORGANIZATION AND EQUIPMENT OF MACHINE GUN SERVICE

A. TYPES OF MACHINE GUNS.

Various attempts made in early days to increase fire power of one man.

1. 1661 — Number of barrels tied together — this idea used in South Africa — rifle batteries and in blockhouses — and in present war before sufficient Machine Guns.
2. 1861 — Gatling Gun — 4 to 10 barrels — hand operated.
3. 1866 — French Mitrailleuse — 25 to 37 barrels — hand-operated. Kept a great secret but misused in Franco-Prussian War — manned by artillery and used at long ranges.
4. Gardner and Nordenfeldt — both hand-operated.

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5. 1883 — Maxim — *first Automatic Gun* — adopted in British Army 1886, to-day remains in principle same although modern "Vickers" gun — 28½ lbs. as against 60 lbs. of Maxim — has replaced it.

6. Other Types.

Colt Machine Gun — Gas operated — air cooled — used by Canadians in present war — weighs 35 lbs. and fires 460 rounds per minute. Fed by a belt holding 250 rounds.

LIGHT PATTERN.

Hotchkiss Light Machine Gun — gas operated — air cooled — used by British Cavalry at present time — weighs 26 lbs. Fed by clip holding 30 rounds.

Lewis Automatic Rifle — gas operated — air cooled — weighs 25 lbs. and fires 600 rounds per minute. Fed by

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magazine holding 47 rounds.

Nearly all belligerent powers now use some form of Maxim or Vickers except Austria. The Germans use a light Maxim. Most countries use a heavy machine gun with machine gun service and light automatic rifle with Infantry.

B. USE OF MACHINE GUNS IN WAR.

1. **South African War** brought out necessity of training mounted troops in fire action as well as shock action. Mobility plus fire power needed there.

Machine guns not sufficiently appreciated there. Germany realized this and was reorganizing her machine guns when the Russo-Japanese War broke out.

2. **Russo-Japanese War.**

Here each power started with a few machine guns.

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Japanese, 4 batteries of 6 Hotchkiss guns each. 1 Battery allotted to each cavalry brigade and none with Infantry.

Russians, 1 company of 8 guns, to be used in support of Infantry.

All guns on carriage mountings. War brought out great value of machine guns — really first used effectually here by both sides.

Result. At end of war each side had greatly increased its machine guns — Russia to 88 — Japan to 320.

Barbed wire and machine guns first became prominent here as greatest obstacles to attack.

3. Present War.

Germany had learned lessons of Russo-Japanese War well and had fully reorganized her machine guns. She had enormous numbers of them. A company of 6 guns attached to each Infantry Battalion and Cavalry Regiment,

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and Jagers also equipped with them. French and English had but few in comparison — 2 per Battalion in British Army at start — soon after 4. Both sides have now greatly increased number of machine guns and are still adding. Light guns used as machine guns only temporarily until machine guns could be made.

Modern preliminary bombardment is the result of the necessity of silencing machine guns. Machine guns are mainly responsible for trench warfare and modern development of artillery. You can cut wire with a few field guns, but to reach machine guns in deep dug-outs you need heavy guns with high explosive, and accurate barrages to the last moment.

Machine guns are backbone of a defense line. It is a point of honor to keep them in action. Machine guns also most useful in attack. There is an instance on record of machine guns alone taking trench.

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Main duty, however, is to protect flanks and hold ground gained.

C. ORGANIZATION.

1. Methods at outbreak of war.

(a) Machine gun section forming an integral part of *Infantry Battalion or Cavalry Regiment* with the O. C. Battalion or Regiment responsible for efficiency — personnel from Battalion or Regiment. This was British system at beginning of war.

(b) Machine gun sections forming an integral part of *Regiment or Brigade,* number of sections equal to number of Battalions in Regiment. Personnel selected from all Battalions; placed under Regimental C. O. with especially selected officers to train them. All sections trained and quartered together. French system before war.

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(c) Selection of men from groups of Regiments, who remain machine gunners all their service — are trained apart as Machine Gun Companies or Detachments. May be attached for service with Infantry Battalion or Cavalry Regiment. Special type for latter. This was the German system at the outbreak of the present war.

2. **Present British System.**

More or less copied from German. Machine guns made a separate arm or branch of the service and a Machine Gun Corps has been created — analogous to Artillery or Engineers.

This Machine Gun Corps is divided into three branches —

(a) *Machine Gun Squadrons* for service with Cavalry — 16 guns, all ranks mounted, both limbers and pack transport — 1 or more

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squadrons to each Cavalry Brigade.

(b) *Machine Gun Companies* for service with Infantry, 1 or more per Brigade. Gun crews not mounted — limbers, and pack horses led by foot soldiers. Company consists of 16 guns.

(c) *Motor Machine Gun Batteries*, 1 or more attached to a Division or form a part of Corps Troops.

Machine Gun Corps first made up by drafts from Battalions and Regiments — now recruited direct and trained from start.

As result of formation of these companies all machine guns were withdrawn from Infantry Battalions and Cavalry Regiments. The latter were then rearmed with *Lewis* and *Hotchkiss* light guns respectively. These latter were not to be used as machine guns, however, but simply as an aid to increased fire

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power. These guns are not adapted to sustained fire because (1) air cooled, (2) lightly made. Because of latter reason they are even more adaptable than machine guns for offensive and as Infantry weapon.

The machine gun sections in Infantry and Cavalry were done away with and their establishment absorbed into strength of Battalion. *Lewis Gun Detachments* were formed, the personnel of which was found from the companies of the Battalions and guns were commanded by Company Commanders.

At present authorized: 6 detachments of 2 guns each or 12 Lewis Guns per Battalion.— 1 detachment per company and 2 attached to Battalion Headquarters.

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CHAPTER III

CHARACTERISTICS OF THE MACHINE GUN

A thorough knowledge of the characteristics of the machine gun is essential, for upon those characteristics is based the tactical employment of the gun.

Caliber and range same as a rifle.

The characteristics and their effect on the tactical employment of machine guns are as follows:

I. Fixed Platform.

Three important conclusions follow from this characteristic.

(1) The personal factor is reduced.

(2) The reduction of the personal factor, combined with the fixed platform, results in the close grouping of bullets.

(3) Suitable for night firing.

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From these conclusions we can make the following deductions *re* tactical employment:

(1) By reducing the personal factor, approximately the same results can be obtained in war as in peace. This also renders the machine gun particularly valuable in a crisis.

(2) The close grouping of fire causes a very restricted area of ground to be beaten; the area beaten by machine gun fire is less than half that beaten by rifle fire. This close grouping makes the machine gun particularly suitable for *surprise effect*, and, in addition, not only facilitates *observation of fire*, but renders such observation reliable.

Another advantage of close grouping is the safety with which fire can be directed, under certain limitations, over the heads of other troops to

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support their advance or increase the volume of fire.

The close grouping of fire is a disadvantage, in that narrow or widely scattered objects, such as machine guns, or extended Infantry, offer unsuitable targets.

(3) The fixed platform makes night firing possible — guns laid by day; also useful on *outposts*.

II. Rapid Production and Application of Large Volume of Accurate Fire.

Gun can be loaded and laid ready for firing and all that there remains to do is to press the trigger.

You can apply accurate fire quickly, because you can generally get observation. As regards rapidity, the gun can be fired at approximately 500 rounds per minute — not 500 rounds in 1 minute, for, after each burst of fire, the aim must be checked and the gun relaid before recommencing to fire.

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The correct point of aim can be picked up more quickly and with greater accuracy than with a number of rifles, for the machine gun officer can often lay a gun on the target himself, if it is difficult to indicate the point he wishes to bring fire on; in any case he has only to make one man per gun understand his wishes, instead of large numbers, as is the case with riflemen.

Owing to the above, machine guns are useful on outposts.

Allow more men to rest. Can be laid on a vulnerable spot in enemy's line for any length of time, with greater effect than riflemen.

This characteristic assists greatly in surprise effect, which is of great importance in the successful employment of machine guns.

III. Narrow Front and Shallow Depth from which a Large Volume of Accurate Fire can be Delivered.

A machine gun occupies the same frontage as two riflemen, or only 6 feet

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frontage required. A comparison between a machine gun and two men with rifles, from a fire power standpoint, points out the value of a machine gun in cramped positions, closed country, villages, etc.

IV. **All-Round Traverse.**

The importance of this characteristic is that a machine gun can be turned quickly in any direction without moving the tripod, thus allowing fire to be delivered in any direction with a minimum amount of movement. Compare this to changing the fire direction of a platoon of Infantry to its flanks as regards movement, vulnerability and time.

V. **Invulnerability.**

Only two men required to operate the gun which only requires from 15 inches to 30 inches of cover. Concealment should always be first consideration, as invulnerability greatly depends on invisibility. It is difficult to put a gun out of action, as only two men are required to fire it.

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Consequently, a machine gun crew can suffer 75 per cent. casualties, without any loss of fire power. Compare this with a similar loss to a platoon of infantry.

From the above we deduct that it is necessary to have all numbers thoroughly trained to take over any position in the crew, and well trained in the use of ground and cover.

VI. **Mobility.**

Compared with infantry, machine guns are more mobile when in limbers or on pack horses, but when in action are less mobile. We deduct from this that when in action all unnecessary movement must be avoided, in order not to disclose position — as few men as possible at gun, and limbers brought up as close as possible.

VII. **Accidental Cessation of Fire.**

Any machine which is automatic is at any time liable to stop, and this is usually due to want of care, or a mechanical stoppage due to some part of the mechanism breaking.

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These stoppages can be divided into two sets: (1) avoidable, (2) unavoidable.

The first is entirely due to carelessness and lack of care in cleaning and examination of parts, ammunition, belts, etc.

The second (unavoidable) on account of the great strain on a machine gun when firing. It is not advisable under normal conditions to keep up prolonged fire, as this only increases the possibility of breakages.

From the foregoing we deduct that a high standard of training is necessary in the remedying of stoppages, and a thorough knowledge of spare parts and how to effect repairs.

VIII. Noise of Firing, Flash, Oil Vapor, and Steam.

The peculiar noise of the automatic firing is unmistakable, but, due to the other noises of battle, it is hard to locate the position of the gun. The flash from a machine gun firing at night is easily seen. Therefore it

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is necessary to erect a screen to conceal this from view, both from the front and flanks.

It is necessary to have the barrels of air-cooled guns thoroughly dry outside as well as inside, for when the barrel heats the oil vaporizes and is liable to disclose your position. With water-cooled guns a condenser should always be used.

The machine gun is a weapon of opportunity particularly adapted for surprise effect, but not for sustained fire action.

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CHAPTER IV

ALLOCATION OF DUTIES

Soldiers selected for machine gun work should possess, as far as possible, the following qualifications: — good physique, good eyesight, calm temperament, fair education and mechanical aptitude.

The elementary training, which may be carried out in the neighborhood of barracks, will consist of instruction in the mechanism of the gun; in adjusting the tripod, mounting and dismounting the gun, in the drill and methods of laying, ranging, and firing; in packing and unpacking limbered wagons; in filling a belt quickly and correctly; in the use of the range finder; in semaphore signaling, and in the signals for the observation and control of fire.

The choice of men to fill the different positions in a machine gun section or com-

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pany should be made through experience of training, and all numbers should be interchangeable.

It should always be a point of honor with every machine gun crew to keep their gun firing under all conditions, and this is only possible with a high standard of training and efficiency; each number in the crew having a thorough knowledge of his own particular duties, and also of the duties of the other gun numbers.

DUTIES.

Section Officer.

1. Have thorough knowledge of *tactical situation.*
2. Select *gun position* (a) by field glasses, (b) by personal inspection of general locality.
3. Give orders regarding line of fire, targets, etc.
4. Give instructions to *range-taker.*
5. Decide *method of fire* and *regulate fire.*
6. Regulate *ammunition supply.*
7. General orders *re limbers.*
8. *Observe fire.*

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Sergeant.

1. Must understand Tactical Situation.
2. Take officer's place, if officer a casualty.
3. Supervise guns coming into action as section officer may direct.
4. Good observer of fire and very conversant with handling of gun.

Corporal.

1. Looks after *limbers* — packing and unpacking.
2. Sees that *spare parts* box is handy.
3. Supervises *ammunition supply* and filling of belts — *expert in belt filling.*
4. Watches for *signals from section officer and sergeant,* and notifies section officer of any change in position of limbers.

Gun Numbers.

No. 1. 1. *Fires* gun. Is best shot in section.

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2. *Cleans* and looks after gun.
3. Carries tripod and assists No. 2 in mounting gun.
4. Carries spare parts wallet.
5. Repeats all *orders*.
6. *Observes own fire* and makes necessary alterations in aim.
7. General supervision of crew and ammunition — usually Lance-corporal.

No. 2. 1. Next to number 1 best shot in section.
2. Carries gun into action and mounts it with assistance of number 1.
3. Watches for *signals* from officer or sergeant.
4. Attends to *feeding* of gun and generally assists number 1.
5. Carries spare barrel — Colt.
6. Works Clinometer and takes it up.

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No. 3. 1. *Carries ammunition* to gun.
2. Expert belt-filler.
3. Carries up condenser (Vickers or Maxim).

No. 4. 1. Expert *belt-filler*.
2. Carries ammunition from limber to number 3.

No. 5 and 6. Ammunition carriers, usually at Central Ammunition Depot or Limbers.

No. 7. 1. Scout.
2. Should be expert in observation of fire.

No. 8. Range-taker.

Officer's Servant.

Acts as orderly to officer. Must be fully trained machine gunner.

Drivers.

1. Take advantage of ground.
2. Understand signals.
3. Belt filling.
4. Be able to replace casualties in gun numbers.

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Signallers.	Four to each company, under Company Commander. Need not be specially trained machine gunners.

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CHAPTER V

BRIEF VOCABULARY OF MILITARY TERMS

COUNTRY SIDE.

Arable Land. Ground under cultivation other than pasture or grass land.

Basin. Low lying ground surrounded by hills, or the country drained by a river.

Col. A gap or break in a ridge of hills.

Crest-line. Where the top of a hill or mountain appears to meet the sky.

Fold in Ground. A slight hollow caused by the regular lie of the ground being broken by a rise or depression.

Knoll. A low hill standing by itself.

Plateau. High-lying flat country. The top of a hill or mountain, if

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flat and of large area, may be said to form a plateau.

Saddle. A shallow central dip in a ridge. The depression is less marked than a Col.

Sky-line. Where earth or sea appear to meet the sky.

Slope — Forward. One that falls away in the direction an observer is looking.

Slope — Reverse. One that falls away behind the spot where the observer is standing.

Slope — Convex. A slope is convex when an observer standing on the crest is unable, through the slope of the hill bulging out, to see the foot of the slope.

Slope — Concave. A slope is concave when the actual slope of a hill offers no obstruction to an observer standing on the crest from seeing the foot of the slope.

Spur. A ridge running out from a hill or from a range of hills.

Valley. Low land between hills or mountains.

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Watercourse. The line marking the lowest part of a valley, whether occupied by a stream or not.

TREES, ETC.

Copse or Coppice. A small wood composed of young trees and undergrowth.

Scrub. Stunted trees and bushes growing closely together.

Shrub. A small bushy tree.

Thicket. A small wood composed of bushes and undergrowth.

Undergrowth. Small trees, brambles, creepers, etc., in a wood.

ROADS, ETC.

Bridlepath. A path along which horses can be ridden or led, but which is not available for wheeled traffic.

Cross-Roads. The point where one road crosses another.

Culvert. A water course arched over with brick or masonry, generally under a road or railway.

Fenced. Bounded by a fence, hedge, wall, etc.

Junction of Roads. The point where

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two or more roads meet, but do not cross one another.

Sunken Road. A road that has been cut below the level of the surrounding country.

Track. An unmade path which is marked by use.

Viaduct. A road or railway carried by a series of arches over a valley, river, etc.

RAILWAYS.

Cutting. An excavation through which a railway line runs.

Embankment. Earth, banked up above the natural height of the surrounding country, to preserve the level of a railway line.

Tunnel. A passage bored through a hill or mountain.

RIVERS, ETC.

Brook. A small stream.

Ferry. A place where a river or other piece of water may be crossed by means of a boat kept at the spot for the purpose.

Ford. A shallow place in a stream

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where it may be crossed by wading.

Right Bank, Left Bank. The right or left bank of a river is the bank on the right or left of an observer facing down stream.

Stream. Any course of flowing water.

Swamp. Land so saturated with wet bog as to be useless for cultivation.

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CHAPTER VI

VISUAL TRAINING AND JUDGING DISTANCE

A. **PRINCIPLES.**

Good shooting depends primarily upon the *accurate location of the enemy's position and movements, combined with certainty in judging distance.*

A man who possesses trained eyesight is a good judge of distance, and has a much greater value on the battle-field, than one who is a skilled shot only.

First difficulty is to see the enemy and to locate your exact target. Seventy-five per cent. of the shots in South Africa were wasted because of *not seeing* and *not recognizing* the target — Indication and Recognition is really a branch of Visual Training, but no matter how well

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target is indicated, it may not be *seen* or *recognized* if eye has not been trained. When target is seen man must be able to estimate accurately distance to it. Otherwise no effect can be obtained.

Modern tactics in open warfare tend to invisibility of everything, uniform, etc., as far as possible; and even in trench warfare, where enemy is rarely more than 200 yards away, and often 50 yards away, it requires a trained eye to detect such things as:

Machine Gun Emplacements.
Snipers' Posts.
New Saps.
New Wire.
Look-out Posts.
Change in Outline of Trenches, or anything that may indicate contemplated activity by enemy.

Similarly, even in trench warfare, it is necessary to be able to judge distance accurately. *E.g.* You see signs of activity behind enemy's lines — working or ration party at

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dusk or dawn — chance for a machine gun — but you must get them *first shot* or they scuttle to cover.

B. VISUAL TRAINING INCLUDES

1. Military Vocabulary.
2. Discernment of targets.
3. Impressions of size.
4. Indication and Recognition of targets.
5. Observation of fire.
6. General reconnaissance.
7. Ability to report correctly what seen.
8. Ability to understand direction given.

Numbers 7 and 8 are question of extending soldier's vocabulary.

In addition to these general terms, every soldier should know terms relating to Military Organization — *e.g.* Battery, Squadron, Brigade, Division, Army Corps, Advance, Flank and Rear Guards, Outposts.

SYSTEM OF TRAINING IN VISUAL TRAINING.— Keyword "**Boer.**"

1. Barracks.

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2. Open country.
3. Examination of ground.
4. Road work.

1st Stage. Barracks.

(A) *With landscape targets.*— Explain: foreground 600 yds., background 2600 yds.

1. Military vocabulary.
2. Visual Training — Set up targets 10 or 15 yds. away and later at 25 yds. (a) Count trees, trace roads, railways, rivers, etc. (b) Examination of ground areas: — Describe every feature in small sector, etc. Study ground for advance and defense — points of tactical importance. Man looks at target for one minute, then turns about and states what he has seen on sector.

(B) *Without landscape targets.*— To teach observation, count windows, chimney pots, objects on table, etc., in a few seconds, and repeat when turned about.

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2nd Stage. Open Country.

(a) Silhouette targets and dummy figures up to 800 yds.

(b) Fatigue men — in shade — in sun — between trees.

(c) Hidden machine guns.

(d) Two squads locating each other.

3rd Stage. Examination of Ground.

(a) Definite lines on landscape described in detail, first by instructor then by class.

(b) Areas of ground described as in "(a)."

(c) Use of field glasses.

(d) Reconnaissance and reports.

4th Stage. Road Work.

To teach men to use their eyes and get an eye for ground.

Take class on march and on returning to barracks ask them questions on what they have observed.

How to Train. Type of country — villages — (size, name); railways — (single, double, state of repair, di-

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rection); rivers — (size, direction and fords); bridges — (type, material); roads — (width, condition, fenced, hedged or open, halting places, positions under cover).

Note wagons passing, what sort of wagon; men passing, what men wore, etc.

N.B. *No talking.*

C. **JUDGING DISTANCE.**

Principal means of ranging.

1. Judging distance — by instrument.
2. Judging distance — by key ranges.
3. Judging distance — by eye alone.
4. By observation of fire.

Other methods.

1. Use of maps.
2. Cross bearings.

***No** means should ever be neglected if time and opportunity permit their use.*

JUDGING DISTANCE BY EYE.

Mean error of privates up to 800

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yds. should not exceed 100 yds. Officers and N.C.O.'s must reduce their mean error to about 10 per cent., under all possible conditions, up to 1400 yds. Impossible to judge beyond 1400 yds. with even approximate accuracy (Only necessary to judge to nearest 50 yds.).

Principal Methods.

1. Unit of measure — class trained to recognize short units commencing at 100 yds. This method is useful only over flat country.
2. Apparent size (if size is known).
3. Visibility — judging angle subtended from eye to object — noting impression object itself, or surroundings, produces on eye, as regards size and distinctness.

AIDS TO JUDGING DISTANCE.

1. **Foresight.**— Know at how many yards a man standing and man

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kneeling is covered by "barley-corn" on gun.

2. **Bracket system.**— *E.g.* range cannot be more than 1800 yds. and cannot be less than 1500 yds. Therefore about 1650 yds. will be correct. Most useful at long ranges.
3. **Half way object.**
4. **Sound and flash.**— 11 beats in 3 seconds — 1 beat represents 100 yds. Sound travels at the rate of 1100 ft. per second. Count number of beats between time flash seen and sound heard.
5. **Thumb method.**— Align thumb at arm's length. Then close right eye and open left. Thumb then appears to have moved laterally to ***right.*** This lateral distance should be *judged* and multiplied by a factor, which varies with each man according to length of arm and width between eyes. Each man has to find his own factor. This method only useful for short ranges. 10 a rough factor

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for every one. Multiply lateral distance by factor. This gives range.

Stand 6 feet from wall and measure lateral distance in inches. Divide 72 by this number and get your factor.

6. **Key ranges.**— Making use of known ranges — most practical.
7. **Comparison of size** with objects known.
8. **Back and forward reckoning** — counting number of paces taken from some known point.

VISIBILITY OF HUMAN FIGURE.

200 yds.— all parts of body distinctly seen.

300 yds.— outline of face slightly confused, buttons resemble a stripe.

400 yds.— outline of body remains normal, but face is not seen except under favorable circumstances.

500 yds.— body begins to taper — movement of limbs easily discernible.

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600 yds.— head a mere dot — details not distinguishable — tapering very noticeable.

700 to 800 yds.— head distinguishable only with difficulty.

800 to 1200 yards — single men resemble a stump.

Note — Remember particularly appearance of man's head and shoulders at all ranges.

Influence exercised by ground and features of landscape.

(a) *Objects over-estimated.*

1. When observer is lying or kneeling.
2. Background and object similar color.
3. On broken ground.
4. Looking over valley or undulating ground.
5. Object in shade.
6. Object seen in mist or failing light.
7. Object partially seen.
8. When heat is rising from ground.

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(b) *Objects under-estimated.*

1. Sun behind observer.
2. Bright light.
3. Background and object different colors.
4. Intervening ground level covered with snow.
5. Looking over water or deep chasm.
6. Looking upwards or downwards.
7. Object large.

RULE.

Target indistinct — tendency to over-estimate.

Target distinct — tendency to under-estimate.

JUDGING LATERAL DISTANCES.

Rough method. Shut one eye, left hand at arm's length, fingers perpendicular, then: —

at 500 yds. 6 fingers cover laterally 100 yds.

at 1000 yds. 3 fingers cover laterally 100 yds.

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at 1500 yds. 2 fingers cover laterally 100 yds.
at 2000 yds. thumb covers laterally 100 yds.

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CHAPTER VII

INDICATION AND RECOGNITION OF TARGETS

Best indication of target is the shortest and most clearly understood description of target.

TWO RULES.

1. Targets must be described as seen by the naked eye.
2. Front must always be allotted.

Description and Recognition of difficult objects necessitates some system of using aids.

METHODS OF INDICATING TARGETS.

1. **Direct Method.**
2. **Reference Points.**
3. **Width of Object on Landscape.**
4. **Reference Points and Finger Breadths.**
5. **Reference Points and Clock Rays.**

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6. **Reference Points and Clock Rays and Finger Breadths.**

7. **Reference Points, Hand and Degrees.**

1. **Direct Method** is used if no doubt can be entertained as to target, as when the target is situated to the Front or "Half Right" or "Half Left," etc.

EXAMPLE.

"Left foreground"— red roofed cottage — chimney on middle of roof.

2. **Reference Points.**

Rules for choosing Reference Points.

(a) *Must be prominent objects.*

(b) *No two Reference Points must be similar.*

(c) *Reference Points must be at least two hands' breadths apart.*

(d) *They must be reasonably distant.*

EXAMPLE.

Poplars — immediately beyond — large green field — at further right hand corner of green field.

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3. **Width of Object on Landscape.**

Target described by indicating object near it and then giving how many widths of object intervene between object and target.

EXAMPLE.

Poplars — right — copse — right —half width of copse — lone bush.

4. **Use of Finger Breadths.**

Rules. (a) *Left hand vertical, palm outwards at arm's length.* If target is immediately above or below the reference point, the fingers will be held horizontally.

(b) Never use both hands or thumb.

EXAMPLE.

Poplars — right — two fingers — large bushy tree.

5. **Clock Ray.**

Rules.

(a) *Clock face vertical, and cen-*

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ter of dial to be placed on reference point.

(b) *Only used in case of uneven ground.*

(c) *Always say "RIGHT" or "LEFT" before "O'CLOCK."*

EXAMPLES.

Chimney — six o'clock — solitary tree in near corner of corn field.

Poplars — right — three o'clock — red house — lower right hand window.

6. **Combination of Clock Ray and Finger Breadths.**

Clock ray to be given before Finger Breadths.

EXAMPLE.

Poplars — right — three o'clock — two fingers — small gap in hedgerow — at right end of gap.

7. This method used when there is a traversing dial on the tripod. Right hand is closed and held out at arm's length. Then align

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knuckle of first finger with reference point and the second knuckle gives three degrees. From first knuckle to knuckle on little finger gives eight degrees. Extended fingers, from little finger to thumb, gives nineteen degrees.

Other methods of target indication.

1. Square on map.
2. Bearing.

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CHAPTER VIII

THEORY OF MACHINE GUN FIRE

A. GENERAL.

Knowledge of theory is very necessary for the machine gunner, to enable him to make the best use of his weapon, and is essential in:

1. Overhead firing — over own troops.
2. Indirect fire.
3. Firing by map, clinometer and compass.
4. Night firing with clinometer.

Forces acting on bullet
1. Explosion of charge.
2. Gravity.
3. Resistance of air.

1. **Explosion of charge:** — Drives bullet forward.
2. **Gravity:** — Natural attraction which draws all unsupported bodies toward center of earth

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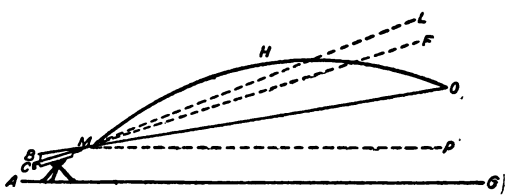
— acts on bullet as soon as it leaves the muzzle.

3. **Resistance of air:** — Causes velocity of bullet to decrease rapidly.

These three forces acting on bullet cause it to travel in a curved line, called *Trajectory*.



B. DEFINITIONS.

Trajectory. Course the bullet takes after leaving the muzzle.

Rifling. Spiral grooves giving spin to bullet on its longer axis, keeping its point forward and ensuring accuracy of flight.

Axis of Barrel. Imaginary line following center of bore from breech to muzzle.

Line of departure. Direction of a bullet on leaving the muzzle.

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Line of sight. Straight line through sights and point aimed at.

Culminating Point. Greatest height above line of sight to which bullet rises in its flight.

Elevation. Raising of barrel to allow for curve of trajectory.

Angle of Tangent Elevation. Angle between axis of bore and line of sight.

Angle of Sight. Angle between line of sight and horizontal plane. It may be either positive or negative according as target is above or below gun.

Angle of Quadrant Elevation. Angle between axis of bore and line of sight.

Angle of Descent. The angle made by a tangent to the trajectory, where it crosses the line of sight, and the line of sight.

Cone of Fire. The figure made in the air by a number of trajectories fired at the same time.

Beaten Zone. Area of ground beaten by a cone of fire.

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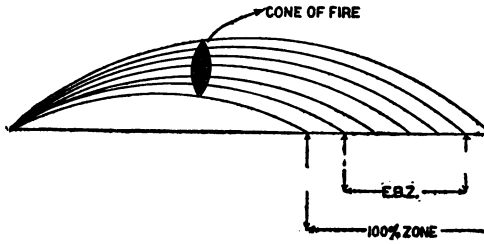
100 Per Cent. Zone. Area beaten by all shots fired at one sighting.

Effective Beaten Zone: — (E. B. Z.) Area of ground beaten by best 75 per cent. of 100 per cent. zone.



E. B. Z. TABLE FOR MARK VII AMMUNITION: —

Range	Depth of E. B. Z.	Width of E. B. Z.
500 yds.	220 yds.	2 ft. 6 in.
800 yds.	172 yds.	4 ft. – in.
1000 yds.	140 yds.	5 ft. – in.
1200 yds.	112 yds.	6 ft. – in.
1500 yds.	70 yds.	10 ft. – in.
2000 yds.	70 yds.	20 ft. – in.

Tables on protractor, in Musketry Regulations and in other text books give: —

Angles of Tangent Elevation for all ranges.

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Height of trajectories.
Dimensions of 100 per cent. zones and E. B. Zones.

C. ERROR OF DAY.

Due to effect of atmosphere and wind — affect elevation and aim.

(a) **Influences affecting Elevation.**

Barometer — pressure of air.
Thermometer — density of air.
Wind — front and rear.
Light — lights up, sights up, and *vice versa.*

Elevation Table.

More for	*Less for*
Dry	Wet
Cold	Hot
Head wind	Rear wind
Bright	Dull

For each of these influences allowance necessary: —

Ranges	Influences	Allowances
Under 1000 yds.	for 1	nil.
	for 2 or more	50 yds.
1000 to 1500 yds.	for 1	50 yds.
	for 2 or more	100 yds.
Beyond 1500 yds.	for 1	100 yds.
	for 2 or more	150 yds.

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Windage Table: Lateral Winds.

Range	Mild 10 miles per hour	Fresh 20 miles per hour	Strong 30 miles per hour
500 yds.	2	4	6 ft.
1000 yds.	3	6	9 yds.
1500 yds.	6	12	18 yds.
2000 yds.	12	24	36 yds.
2500 yds.	24	48	72 yds.

For oblique winds halve the above.

	Trees	Water
Mild Wind,	Leaves tremble	Ripples.
Fresh Wind,	Branches bend	Small waves.
Strong Wind,	Trunk bends	Large waves.

Movement: *Allow*

Man walking 1 ft. per 100 yds.
Man doubling 2 ft. per 100 yds.
Horse trotting 3 ft. per 100 yds.
Horse galloping 4 ft. per 100 yds.

In ordering deflection or "Aiming Off" give an auxiliary aiming mark when possible. Next best method is to order gunner to aim off in hands' breadths — *former* always used for moving targets.

KINDS OF FIRE.

Frontal. Delivered directly to front.

Oblique. Fire directed on target in a

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slanting direction. At angle of 45 degrees oblique fire gives 30 per cent. increase of effect over frontal fire.

Reverse. Bullets strike target from rear.

Enfilade. Fire which sweeps line of troops or trench from flank.

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CHAPTER IX

FIRE DIRECTION

FIRE DIRECTION.

As applied to machine guns includes all theories and methods which ensure that fire is applied to best advantage. Guiding principle is that fire is applied in bursts. Bursts vary in size according to nature of target and position from which it is engaged.

METHODS OF MACHINE GUN FIRE.

1. **Ranging Fire** — Bursts of 10 to 20 rounds. Use is to obtain range by watching strike of bullets. Trained soldiers should be able to observe fire up to 800 yds. by eye, and up to 1400 yds. with glasses.

Before using consider whether: —

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(a) Surprise effect will be lost by using it.

(b) Nature of ground is such that observation will be obtained. If ground at target is not suitable, fire at road or field near by.

Method of using

Lay on target with sight about 200 yds. less than estimated range. Observer signals what he sees, not correction to be made. Elevate gun until "Range Correct" is given by observer. N. B. Shots may be observed short of target when target is in center of cone of fire.

Fire Order — (one gun)

700 — Cross-roads in front — Ranging.

Note — Orders to fire given by signal or word of mouth.

2. **Rapid Fire** — Bursts of 20 to 50 rounds. Normal fire of machine guns. Between bursts firer ensures that gun is correctly laid.

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Fire Order — 700 — Cross-roads in front — Rapid.

3. **Traversing Fire** — Bursts of 5 to 10 rounds. By use of automatic tap, with one belt, one gun can cover 25 yds. of front in one minute at ranges up to 1000 yds. and have no gaps greater than 1 ft. 6 in.

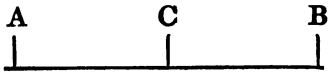
(1) To right or left.
(2) Inwards.
(3) Outwards.

Fire Orders.

(1) One gun.

1200 — Left end of hedge in front — to the right — Traversing.

(2) (a) Two guns.



1100 — Hedge in front — Inwards Traversing.

Left gun lays on "A," right gun on "B"; both guns traverse inwards to "C."

(2) (b) Four guns.

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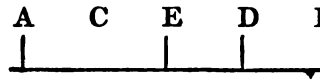

1100 — Hedge in front — "A" to "B" — Inwards Traversing.

Four guns lay on A, C, D and B respectively, and traverse to C, E, E, and D respectively.

(3) Four Guns.

1100 — Hedge in front — "A" to "B" — Outwards Traversing.

Two center guns lay on "E"; outside guns on "C" and "D" and traverse "E" to "C," E to D, C to A and D to B respectively.

N. B. By taking four points of aim

(a) Fire is distributed.

(b) Target is hit in four different places.

(c) Greater chance for observation of fire is obtained.

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4. **Swinging Traverse** — Large number of rounds fired continuously with traversing clamp loose. Used at close ranges against dense targets. Should not be used at ranges greater than 500 yds. Care should be taken that gun is not swinging too quickly.

Fire Orders.

300 — Enemy in front — Swinging Traverse.

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CHAPTER X

COMBINED SIGHTS AND VERTICAL SEARCHING

Before opening fire on any target it is necessary to consider:

(a) **Error of Day.**

(b) **Error in Ranging.** Allowance for this is made by artificially increasing the depth of the E. B. Z. The amount of increase necessarily depends on:

1. **Probable Error.** This is the error that will probably be made in taking range and is:
   (a) With range-finding instrument — 5 per cent.
   (b) By eye with assistance of key ranges — 10 per cent.
   (c) By eye alone — 15 per cent.
2. **Permissible Error.** This is the error you may make and still hit the tar-

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get. This error is one-half the depth of the E. B. Z.

Example of Permissible Error:

Range to target estimated to be 1000 yds. E. B. Z.— 140 yds. Permissible Error — one-half of E. B. Z.— 70 yds.

A. No error in obtaining range.

B. 7 per cent. error or 70 yds.— one-half depth of E. B. Z. may be made and still target will be hit.

C. 10 per cent. error or 100 yds. This exceeds Permissible Error. Therefore, depth of E. B. Z. must be increased artificially. Probable Error is greater than Permissible Error.

If Probable Error is greater than Permissible Error, E. B. Z. must be increased in depth artificially.

METHODS OF INCREASING E. B. Z.

1. **Combined Sights.** Is two or more guns firing at same target with different elevations. It is not necessary that all guns be laid on same point of target. Better

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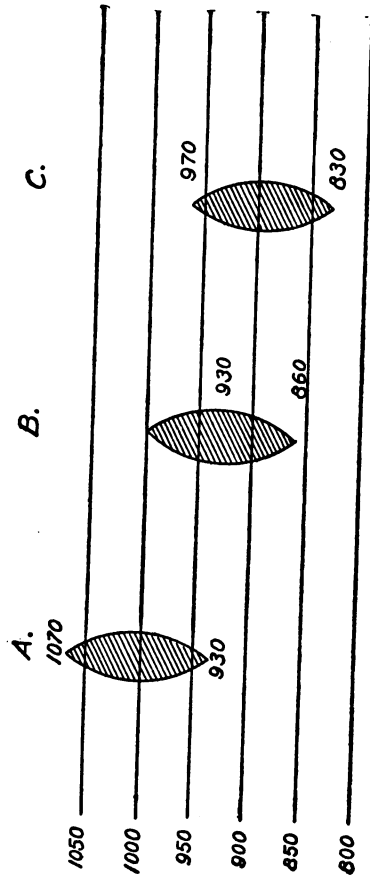

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observation is obtained by laying on different points.

Rules.

1. Normally not necessary up to 800 yds.
2. 800 yds. to 1200 yds. use 100 yds. differences in elevation between guns.
3. Over 1200 yds. use 50 yds. differences.
4. With 4 guns or more use 50 yds. differences for all ranges.
5. Amount of ground to be searched to assure hitting target is twice Probable Error, because error may be plus or minus.
6. To find number of guns required divide number of yards to be searched by difference in elevation between guns.
7. Target should be in center of increased E. B. Z.
   (a) Where there is an odd number of guns use one

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gun at estimated range and an equal number on either side.

(b) Where there is an even number of guns, use one gun at estimated range and it is usually better to place the greater number of remainder below target.

8. E. B. Z. of each gun must overlap those on either side.

9. Combined Sights should not be used if Tactical Situation and ground are favorable for Ranging Fire. Combined Sights should be discontinued as soon as gun using correct elevation can be observed.

To find depth of combined E. B. Z. multiply number of guns less one by difference in sighting used and add E. B. Z. of center gun., e.g. 1000 yds. — 4 guns (4 — 1) x 50 plus 140 = 290 yds.

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Example 1 — 2 guns.

Range to target 1000 yds. by Key Ranges.

(a) Probable Error 10 per cent. of range, 1000 yds. = 100 yds.

(b) Ground to be searched = 100 yds. x 2 = 200 yds.

(c) Differences used 100 yds.

(d) Number of guns required = ground to be searched, 200 yds., divided by differences used, 100 yds. = 2 guns.

(e) Required elevation 950 yds. and 1050 yds.

Fire Order.

Combined Sights — 2 guns — 950 — 100 yard differences — haystack in front.

N. B. Number 1 of first gun repeats order. Number 1 of next gun says — "1050 — 100 yd. differences." The guns always number from the flank from which the fire orders are given.

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This generally depends on type of gun used.

Example 2.

Range to target 1000 yds. by Judging Distance by Eye.

(a) Probable Error 15 per cent. of range, 1000 yds.= 150 yds.

(b) Ground to be searched = 150 yds. x 2 = 300 yds.

(c) Differences used 100 yds.

(d) Number of guns required = ground to be searched, 300 yds., divided by differences used, 100 yds.= 3 guns.

(e) Required elevation — 900 yds.— 1000 yds.— 1100 yds.

Fire Order.

Combined Sights — 3 guns — 900 — 100 yd. differences — haystack in front.

Ground to be searched 300 yds. — 850 yds. to 1150 yds.

Ground actually searched 340 yds.— 830 yds. to 1170 yds.

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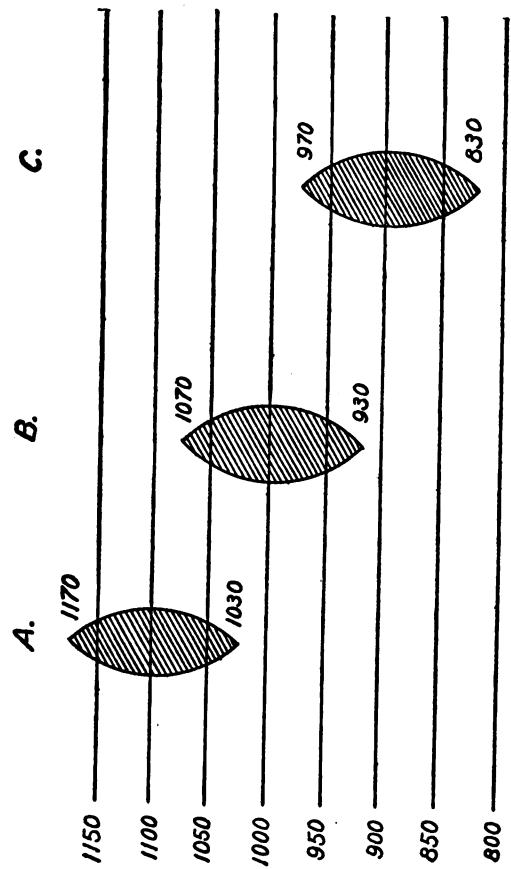

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Cones of fire overlap 40 yds.

2. **Vertical Searching** is method of increasing E. B. Z. when only one gun is available.

Methods of Using.

1. Lay gun on nearest end of target with range to same on sights.
2. Without altering elevation of gun move sights up to range required to strike far end of target.
3. Elevate by 8 minute turns, firing bursts of 10 to 20 rounds between each elevation, until near end of target is again seen over sights. Cones overlap at any range using this method.

Fire Order.

800 — Near end of hedge in front to far end — Vertical Searching.

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CHAPTER XI

FIRE ORDERS AND SIGNALS

METHOD OF GIVING ORDERS.

1. Pass order from No. 1 to No. 1.
2. Send orderly to each gun.
3. Send orderly to lay each gun.
4. Call No. 1 of each gun.
5. Lay 1 gun and have No. 1's of each gun look over sights.

N. B. Order to fire practically always given by signal.

SIGNALS.

1. **For Fire Orders.**

ACTION — Both arms extended in line with shoulders and lowered and raised.

OUT OF ACTION — Arms swung with circular motion in front of body.

OPEN FIRE — Hand dropped from raised position.

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CEASE FIRE — Elbow close to side, hand waved horizontally.

GUN READY TO FIRE — Hand in line with head.

2. For Observation of Fire.

P — (Plus) — Fire observed 50 yds. beyond target.

PP — Fire observed 100 yds. beyond target.

M — (Minus) — Fire observed 50 yds. short of target.

MM — Fire observed 100 yds. short of target.

T — Fire observed to right of target.

L — Fire observed to left of target.

C — (Center) —Direction correct.

R — Range correct.

Q — (Query) — Fire observed but uncertain.

U — Unobserved.

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CHAPTER XII

NIGHT FIRING

Night firing is possible owing to fixed platform of machine gun.

AUXILIARY LINE OF SIGHT.

Is line of sight to an auxiliary mark other than target to be obtained. Object is to enable firer to obtain elevation and direction when target is not visible.

METHODS OF USING AUXILIARY AIMING MARK.

1. Gun laid by day and left in position.
   (1) Lay gun on center of target with correct range to target on sights.
   (2) Place auxiliary aiming mark in front of gun in direct line between gun and target.
   (3) Without moving gun, adjust Tangent Sight slide until line

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of sight cuts center of auxiliary aiming mark. Note carefully reading on sights.

2. Gun laid by day, but gun, tripod and auxiliary aiming mark removed and set up again at night.
   Same as above but gun, tripod and auxiliary aiming mark removed after exact position of each has been marked by stakes or similar devices.
3. Gun brought into position for first time at night.
   By day select positions for gun and auxiliary aiming mark and mark with stakes not more than 6 in. high. Place another stake directly in line with target. Note range to target. At night place gun in position and lay in direction of stake. Place correct elevation on gun by means of clinometer.

Use as Auxiliary Aiming Mark.

1. Night firing box.

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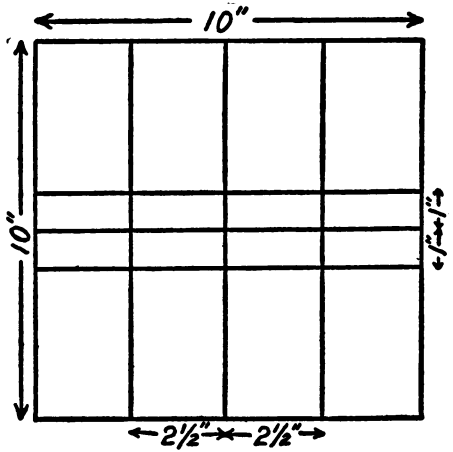
2. Siege lamp.
3. Luminous spot on stick of wood or piece of rock.

N. B. Supply yourself with luminous paint to put on aiming mark and sights.

Night Firing Box easily prepared by tacking linen or white paper on rough frame 10 in. square.



Lines of face of box for Searching and Traversing 1-3 in.

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wide. Box lit up by electric torch or lamp.

Box to be placed 10 yds. from foresight and in line between gun and target. Horizontal lines are 1 inch apart, giving an angle of 10 minutes at 10 yards. Vertical lines are 2½ inches apart, and this at 10 yds. gives approximately a lateral amount of 2 ft. per 100 yds.

If Night Firing Box cannot be placed ten yds. in front of foresight place mirror in direct line between gun and target and place Night Firing Box to right or left of mirror, so that total distance, foresight to mirror, and mirror to Night Firing Box is 10 yds. Turn mirror until Night Firing Box is reflected to eye of gunner.

Other Methods

1. Lay gun on target. Place *2*

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stakes firmly in ground to mark right and left limits of traverse and in such a position that the forward end of the barrel of the gun will bear against stake when limit of traverse has been reached. To mark upper and lower limits of searching, fasten two horizontal sticks to up-rights. In using horizontal sticks particular care should be taken that legs of tripod do not sink, otherwise limits do not hold good. This is also useful method for marking right and left limits of field of fire in belt of fire.

2. **Trench Mount** for traversing. Gun pivots near muzzle. Lay gun by day. Note degree indicated on half circle of mount and elevation by elevating dial or clinometer.
3. Traversing Dial and Elevating Dial.
4. Prismatic compass and instru-

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ment for measuring angles of elevation.

N. B. (a) In using flash light to read compass, dial or clinometer, best method is to put two folds of khaki handkerchief over light and stand with back to enemy.

(b) In using clinometer, check up elevation after every few bursts, as legs of tripod are liable to sink.

(c) In using compass do not hold near gun or tripod as needle will be deflected. Place stake in ground to mark center of tripod and hold compass directly over stake.

(d) Flash of gun when firing is more than likely to give away position. When firing at short ranges, fire through double screens of wet sand bags stretched over chicken wire. At long ranges the retarding influence of the sand bags causes bullets to fall short. If possible at long ranges fire over screen.

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CHAPTER XIII

OVERHEAD FIRE

Overhead fire is possible owing to fixed platform and close grouping. It is fire directed over heads of own troops.

OBJECTS.

1. To cover advance of own troops.
2. To increase fire effect on any particular portion of enemy's lines.
3. To cover enemy communication trenches and prevent supports coming up.

RULES.

1. At close ranges use only from or at a commanding position or across a valley. Not to be used at ranges greater than 1500 yds. unless own front line is lower than gun and target.
2. Good observation of fire and own front line must be obtained.

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3. Barrel must be in good condition.
4. Tripod must be on solid ground.
5. Range to target must be obtained to within 5 per cent. error.
6. Number 1 must be expert firer.
7. If range is 1000 yds. or under, line of sight to target and own front line must contain angle of not less than 30 minutes.

   If range is between 1050 and 1500 yds. same angle must not be less than 60 minutes.

   This is called the Safety Angle and allows for 15 per cent. error. Of this 5 per cent. is for Judging Distance and 10 per cent. for deterioration in gun and ammunition.

SAFETY ANGLE MAY BE OBTAINED BY:

1. Graticules.

   (a) If range is 1000 yds or under.

   Place 600 Graticule on line of sight to target. Where line of sight from eye through zero to ground cuts ground is limit of safety for own front line.

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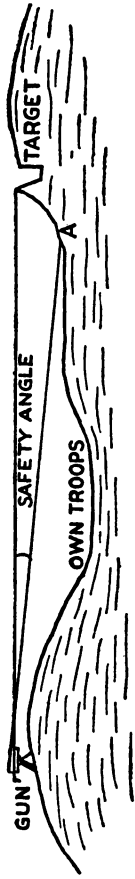

"A" IS LIMIT TO WHICH OUR OWN TROOPS CAN ADVANCE IN SAFETY

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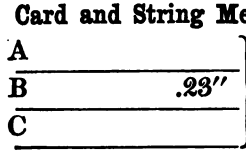
Gives rough angle of 30 minutes.

(b) If range is 1050 to 1500 yds. Place 1000 Graticule on line of sight to target. Where line of sight from eye through zero to ground cuts ground is limit of safety for own front line. Gives rough angle of 60 minutes.

2. Card and String Method.



A to B gives angle of 30 minutes, and is .23″.

A to C gives angle of 60 minutes, and is .47″.

3. Tangent Sight Method.

Gun laid on target with sights adjusted to correct distance. Then raise sights without moving gun.

1. If range is 850 yds. or below, raise slide 400 yds. Where new line of sight cuts ground

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is limit of safety for own front line. Rough angle of 30 minutes.

2. If range is 900 yds. or over, raise slide 250 yds. New line of sight is limit of safety for own front line — rough angle of 60 minutes. Use second aiming mark when firing, and when own troops come to line of sight, aim at leading man and follow him with sights until he reaches objective, provided objective is not farther away from gun than 1500 yds. If it is farther away stop when leading man is 1500 yds. from gun.

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CHAPTER XIV

INDIRECT FIRE

INDIRECT FIRE

Is fire directed over an obstacle which obstructs the view of the firer to the target.

SELECTION OF SITE.

1. Be sure that flash is hidden.
2. Make cover for crew from stray bullets.
3. Best position is reverse slope of hill.

METHODS.

1. **Graticule Card.**

   Graticules represent angles of elevation for machine gun. Topmost Graticule represents zero and lines below every hundred yards from 200. Card is practically the same as Tangent Sight inverted.

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Before this method can be used it is necessary that auxiliary aiming mark in direct line of sight from gun to target can be seen by observer. Method becomes inaccurate when eyes of man using Graticule Card are more than 6 feet above gun.

Procedure.

1. Obtain range to target.
2. Hold Graticule Card at full length of string with thumb on Graticule representing range to target. Align this Graticule on target. Observe at what graticule good aiming mark above gun is seen. The range corresponding to that graticule is the Tangent elevation at which to open fire, using selected object as an aiming mark.

2. Spirit Level Method.

Gun and target must be on same level.

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1. Align gun on target with sights at zero.
2. Level gun with Spirit Level.
3. Place aiming mark on near side of obstruction on level with line of sight.
4. Set sights at range to target.
5. Relay on aiming mark.

To find if bullets will clear obstruction set sights at range to same, and, if line of sight clears obstruction, bullets will. N. B. This method is not to be used for Overhead Fire.

3. **Spirit Level, Elevating Dial and Map.** From map find difference in elevation between gun and target, also range. Calculate angle of sight by formula — angle of sight in minutes equals difference in height between gun and target in inches, divided by number of hundred of yards in range.

To find elevation to put on gun, add or deduct Angle of Sight thus found, to or from Angle of Tan-

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gent Elevation for range, according as target is above or below gun. This is Quadrant Elevation.

Then level gun by means of Spirit Level. By means of Elevating Dial elevate gun through Quadrant Elevation. With sights at any range select aiming mark on near side of obstruction.

4. **Clinometer and Map.**

Find Quadrant Elevation as above. Set Clinometer at Quadrant Elevation found as above, and place on gun, if target is above gun arc of Clinometer to rear; if target below gun arc to front. Level bubble on Clinometer by means of elevating or depressing gun. Number 1 must maintain holding on gun, while working elevating wheel.

This method may be used for Overhead Fire, if further calculations are made to ensure safety of own troops.

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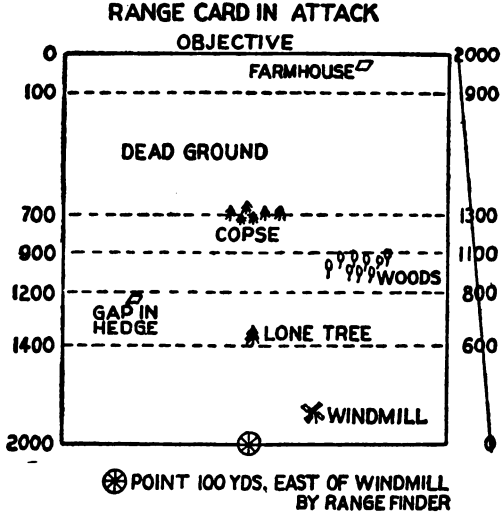
CHAPTER XV

RANGE CARDS



1. RANGE CARD IN ATTACK.

Is made previous to going into action for purpose of giving Fire Control

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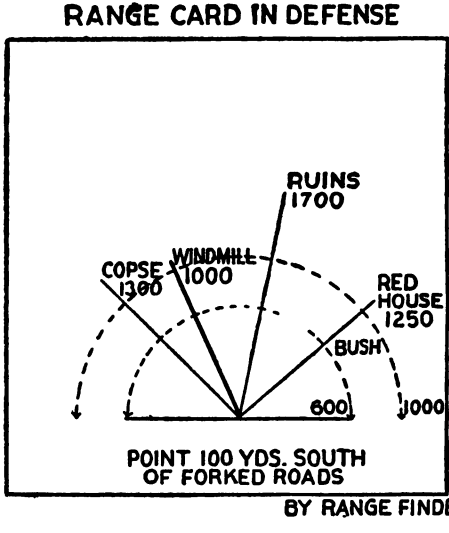
Commanders information as to range to enemy from prominent objects on landscape over which advance is to be made.

Rules.

1. Draw base line to represent own



frontage proportional to line representing distance from own position to enemy's position.

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Describe portion of frontage represented by base line.

2. Draw side lines from flanks of base line to enemy's line.
3. Fill in names of all prominent objects between own position and enemy and some description of nature of land.
4. All writing to be in block letters.
5. Draw lines horizontally across Range Card to show range in hundreds of yards to or near prominent objects.
6. Using base line as zero point, fill in outside right side line ranges to lines across range card.
7. Change figures to left side, changing them so that enemy's line is zero line, and cross out figures on right side.
8. Range Cards for M.G. sections will show possible machine gun positions, fields of fire and covered ways.

2. RANGE CARDS IN DEFENSE.

Compare with attack Range Cards

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(1) No definite frontage.
(2) Artificial ranging marks set out.
(3) Flanks as well as front.

Rules.

1. Mark point from which range is taken and describe it clearly.
2. Draw two semi-circles representing the 600 and 1000 yd. limits.
3. Draw heavy line to most prominent object on landscape. This is called Setting Ray.
4. Draw lines to other prominent objects on landscape. Make Rays proportional in length to length of Setting Ray. Have angles accurate.
5. Write at end of ray range to object, description of object and bearing.
6. All names in Block Letters.

N.B. On all Range Cards method of taking ranges should be noted.

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CHAPTER XVI

THE OCCUPATION OF VARIOUS POSITIONS BY MACHINE GUNS

The occupation of all positions is governed by:

(a) Effect likely to be obtained.

(b) Safety of the Detachment in Action.

(c) Line of Communication, and Ammunition Supply.

(d) Nature of Action.

1. BARRICADES.

(a) When barricading Roads, Bridges, Streets, etc., the Barricades should be made as strong as possible. Dummy barricades, apparently bullet proof, but really not so, can often be placed in front of the real one with advantage. This device may deceive the enemy

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as to the exact position of the Barricade, and if he attempts to rush the Dummy, he can be subjected to very heavy fire.

(b) The placing of machine guns on the barricade should be avoided, if equal effect can be obtained by placing them elsewhere in positions commanding the approaches to the barricade.

2. BANKS.

The banks of rivers, canals, streams, etc., can be made good use of for gun positions, and for covered lines of advance or retreat.

They provide an entrenchment already made which can be rapidly improved.

The best use of banks is obtained when the front legs of the tripod are dug well into the bank.

Even small banks on the edges of roads should not be neglected, as they afford cover which can be rapidly improved.

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3. CROPS.

Standing crops afford useful cover for machine guns, and provide concealed lines of advance, etc.

Care should be taken to avoid being seen entering the crops and the edge from which it is intended to fire must not be too closely approached.

If the machine gun is obliged to remain far back in the crop, the field of view will naturally be restricted; but even should the Number 1 be unable to see his target, accurate fire can often be obtained by observation from a flank.

It may be necessary to raise the gun platform to obtain field of fire.

4. DITCHES.

These can often be used to enable machine guns to be pushed forward so as to bring oblique or enfilade fire to bear on enemy.

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Care must be taken not to show above the banks of the ditch. A few men should be pushed along the ditch, on the exposed flank, as a protection against snipers, counter-attacks, etc.

5. FOLDS IN THE GROUND.

Use can be made of small folds in the ground for the concealment of machine guns. The machine gun should be placed so as to enable the bullets to clear the crest, while being as little as possible exposed itself.

A great deal of practice is required in crawling into position and in judging exactly how far from the top of the fold to place the machine gun.

6. HAY STACKS.

These can be made use of as follows: —

(a) Hollow out *front* of Haystack. Number 1 sits in this hollow with his back against the hay. The loose hay is piled up in front of the machine gun.

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(b) Cut out a place for the machine gun on top of the haystack. If possible make a rough platform of boards. The gun then fires over the top of the ridge of the haystack.

(c) Place the machine gun behind the stack in such a manner that oblique or enfilade fire may be brought to bear on the enemy. The gun is then entirely concealed from the front. This is, as a rule, the best method of using a haystack.

Note.— Avoid single haystacks.

7. **HEDGES.**

Can often be used as a covered approach, and as fire positions giving cover from view. A few men should be placed along the hedge, on the exposed flank, for protection.

8. **HOUSES.**

Care must always be taken to arrange for a hasty retirement from any building, as, if the

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presence of a machine gun is detected, artillery will be directed against it.

Houses may be used as follows:

(a) Place the machine gun back from the window or door of a room, firing through an open window from which a few panes of glass have been removed.

(b) Remove a few tiles from the roof and fire through the opening thus made.

(c) Should a house have two doors, or two windows directly behind one another the machine gun may be placed in rear of the house and fired through these windows or doors.

(d) Place the machine gun in rear of the house so that enfilade fire can be brought to bear on the enemy.

(e) If the house possesses a cellar the machine gun may be placed in the cellar, and a few bricks removed so as to enable the gun to fire from the ground level.

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(f) In whatever position the machine gun is placed, some protection should, if possible, be provided for the crew, such as an emplacement of sand bags, stones, bricks, etc.

(g) Isolated houses should usually be avoided.

Notes.— When machine guns are mounted in buildings the cellar should be prepared as bomb-proof shelters for the teams. A strong dug-out at the back of the house is often better than the cellar itself.

In occupying buildings of any kind care should be taken to see that they are bullet proof. A large number of small houses, barns, etc., have mud or single brick walls which are not bullet proof.

9. MOUNDS OF EARTH, ROOTS, ETC.

These may be used as follows: —

(a) Hollow out the mound from the rear, so that the machine gun

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can be fired from the hollowed out place while being concealed from the front. Planks, sand bags, etc., can be used to support the earth.

(b) Fire over top of mound, using mound as a parapet.

(c) Place the machine gun behind the mound, using mound as cover from the front, while oblique or enfilade fire is brought to bear against the enemy.

10. STACKS OF WOOD.

The stack may be hollowed out from the rear so that the machine gun can be placed inside the stack and fire to the front, while being perfectly concealed from view.

The position can be strengthened by using sand bags inside the stack; stacks of planks leaning against buildings may also be used.

11. STOOKS OF GRAIN.

Place the machine gun behind the

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stooks. It can then fire through to the front while being concealed from view.

12. **TREES.**

Trees when in leaf may be considered as possible machine gun positions. Trees with strong branches are necessary, and a platform for the machine gun must be built in the branches.

Positions in trees are usually dangerous, as the upper parts suffer severely from shrapnel fire, if they are subjected to it.

13. **WOODS.**

Woods, especially when in leaf, are often most valuable for concealing the positions of machine guns.

Care must be taken that the machine guns are not placed too near the edge of the wood and that individual men do not expose themselves.

All communication between machine guns should be made in

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the wood well in rear of the guns.

Alternative positions should be selected so that machine guns may be rapidly removed from one to another, if desired.

Lines of communication through the wood must be arranged, and lines of communication between the machine guns and limbers also thought out.

Rides and paths in the wood are the best places to arrange for communication, rallying, etc., during an advance or retirement. But care should be taken to avoid showing for too long in the ride itself.

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CHAPTER XVII

MACHINE GUNS IN OPEN WARFARE

PART I

GENERAL PRINCIPLES.

It is essential that the general principles of the employment of machine guns should be carefully considered. Unless this is done, it will be impossible to make the best use of these weapons.

These principles are exactly the same in either open fighting or trench warfare; but to obtain the best effects from machine guns on all occasions, both kinds of warfare must be studied.

Responsibility of Command.— Machine Gun Company Commander issues orders to Section Officers on basis of orders issued by Brigadier. (These

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orders should not be too rigid.) If possible orders to be issued some time before they are to be carried out. If attached to battalions for special duty Machine Gun Officer must be prepared to take orders from Officer Commanding Battalion.

Issue of Orders.

1. Through Section Officer.
2. Direct to Numbers 1.
3. By Orderlies to Section Officer or Numbers 1.

Control of Guns.

1. Singly.
2. By sub-sections of 2 guns.
3. By sections.

Reconnaissance.

The two most important factors in employment of machine guns are: —

1. Surprise.
2. Concealment.

Both depend on good and careful reconnaissance — (a) Study of ground from prone position; (b)

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Study of ground from hostile point of view.

Methods.

1. By actually going over ground.
2. Study of ground through glasses.
3. Study of maps, sketches, etc.

From Maps Following Information Can Be Gained.

(a) General topographical features.

(b) Position of roads, railways, rivers, etc., both in front and rear of hostile lines.

Maps may be very misleading on account of changes.

Coöperation.

Machine Guns must always coöperate with each other and other branches of service.

1. Between machine guns.

Always work under a prearranged plan, thereby avoiding gaps and overlapping. Guns on adjoining flanks of two machine gun units must keep in touch with each other and cooperate.

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2. Between Machine Guns and Infantry.
   (1) Direct overhead fire.
   (2) By firing from a flank (covering fire).
   (3) By advancing with Infantry.
   (4) By engaging hostile troops on threatened flank.
   (5) By covering retirement.
3. Between Machine Guns and Artillery.
   (1) By taking advantage of work done by artillery, either by advancing or by engaging hostile troops retiring.
   (2) By supplying information regarding position of hostile machine gun positions.

Justification for Opening Fire.

1. Surprise.
2. Effect on enemy.

It is of the greatest importance in handling machine guns that fire should not be opened until the most favorable moment. The greatest effect has been

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produced when the enemy has been allowed to approach to within 300 yds. or even closer range. The longer the range the greater loss of accuracy. The shorter the range, the greater the element of surprise, and the less the chance of the enemy finding cover.

At Courcelette, September, 1916, one German counter-attack was allowed to advance to within 100 yds. before the machine guns opened fire. So demoralizing was the effect that 400 Germans threw down their arms and surrendered, upon finding themselves enfiladed by 2 machine guns.

3. Supporting own Infantry.
4. Self-defense.

Targets.

Troops advancing in depth at effective ranges usually good.

Troops advancing in extended order usually bad, but can be

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greatly improved by employing enfilade or oblique fire.

Movement.

1. Avoid all unnecessary movement.
2. When possible move into position under cover.
3. Adopt similar formation to surrounding troops.
4. In action masks and gloves should be worn.

Selection of Fire Positions.

1. Field of fire (one to two hundred yds. sufficient) and fire effect.
2. Facilities for observation, concealment and cover for all.
3. Facilities for ammunition supply.
4. Alternative position, out of shell area of first position; covered approach from one position to the other.

Actual Gun Positions.

Should be selected from a prone position. Gun mounted as low as possible.

Positions to Avoid.

1. Obvious positions.

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2. A back-ground which will expose gun.
3. A position which is easy to describe, especially from a map.
4. One which is easy to range on.
5. Near prominent objects.

The best position is in the open in a fold in the ground.

Concealment.

1. Natural cover.
2. Digging (avoid too much movement).
3. Combination of both (in a wood).

Guns should be "dug in" whenever possible. In certain cases it may not be advisable, if the act of digging is likely to give away an otherwise well concealed position. Machine guns well concealed in crops, scrub, folds in the ground, etc., will be far safer from the mere fact of their concealment, than a hastily "dug in" machine gun that has been located.

To prevent surprise, or with a

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view to taking advantage of a fleeting opportunity, guns should be mounted on their tripods before digging is commenced.

Machine Guns and Artillery.

Every effort must be made to prevent machine guns being located by artillery.

If machine guns are shelled they must either: —

(a) Change their positions at once. This would be the usual proceeding. A movement of quite a short distance, is quite sufficient in many cases; or

(b) Cease fire while detachments take cover until the shelling ceases. If this is done, the hostile artillery may think that the machine guns have been put out of action.

Good targets may then present themselves, and the guns may be able to reopen fire with

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good effect from the same position.

There have been several cases of machine guns firing against artillery with great success.

The following instances are quoted: —

1. A section of machine guns worked forward to a concealed position 900 yards from an enemy field battery in action. The section brought oblique fire to bear on the battery and completely silenced it.
2. A section took an enemy field battery in enfilade at 2400 yds. The battery was firing at the time; the gunners fled from their guns, and the battery was silenced.

Protection.

Machine guns, in spite of their great fire power, are very vulnerable to the attack of riflemen who may stalk them on

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suitable ground, and pick off the gun numbers.

Need of protection when in action,— ditch, hedges, etc. Protect flanks particularly with bombers.

M.G.'s should not be sent on a detached mission without being provided with a suitable escort.

If a Machine Gun Officer feels the necessity for protection of this kind, he should apply to the nearest unit.

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CHAPTER XVIII

MACHINE GUNS IN OPEN WARFARE

PART II THE ATTACK

1. PRELIMINARY ARRANGEMENTS.

(a) Importance of a constructive policy.

(b) First considerations pending orders:

1. Best positions for supporting attack.
2. Best distribution of guns.
3. Points in enemy's lines susceptible to machine gun fire.
4. Try to locate enemy's machine guns.
5. Select further positions by means of maps.
6. Coöperation with Lewis Guns.
7. Ammunition supply.
8. Determine position of limbers.
9. *Procure ranges likely to be used.*

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Action of Machine Gun Company Commander on Receipt of Orders from Brigadier.

He informs Brigadier of his intentions. Then issues orders.

Action of Section Officers.

1. Let men know their different tasks.
2. Let men know general tactical situation.

Method of Supporting Infantry.

1. By fire from flanks.
2. Overhead fire.
3. Long range searching fire.
4. From forward positions.

Distribution of Guns and Their Duties.

1. Those allotted to the attacking Infantry.
2. Those covering advance of Infantry.
3. Those in reserve in hands of Brigadier.

Methods for Above.

1. Some will be pushed well forward to help gain superiority

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of fire. The remainder held back to keep down flanking fire. All cover retirement in case attack is unsuccessful. Go forward and consolidate positions won, pursue enemy with fire. They should not go forward to the captured positions until sure of success of attack.

2. They may be on flanks or in a commanding position in rear. By being on flanks can keep up a direct fire and protect flanks, search out position in enemy's rear. When these guns have done their work they come under Machine Gun Company Commander once more.

3. Must be a real reserve; not used too early in the fight. They may be used to employ long range searching fire, and to cover advance of own troops.

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Transport and Ammunition Supply.

1. When teams are being shelled by hostile artillery.

Methods.

1. By means of pack animals.
2. Get carrying party from Infantry.
3. Use forward dump of ammunition.

2. No artillery.

Method.

Chain method — limbers should have Transport Officer in charge of ammunition supply.

Position of Commanders.

The Machine Gun Company Commander will be with Brigade Headquarters.

Section Officers will be: —

1. Where they can observe fire.
2. Where they can observe movement of own troops, and also enemy.
3. Where they can keep in touch with reserve guns.

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Advanced Guard.

1. The duties of an Advanced Guard make it necessary that great fire power should be available when required. A large proportion of machine guns should therefore be allotted to advanced guards.
2. These machine guns should move well forward in the column, so that they may be able to get quickly into action.
3. The principal duties of machine guns with the advanced guard are: —
   (a) Assist in driving back enemy forces by rapid production of great fire power at any required point.
   (b) Assist in holding any position gained until the arrival of the Infantry.
   (c) Cover the deployment of the main body by holding the enemy on a wide front.
4. Lewis Guns should be employed with the van-guard, the ma-

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chine guns being with the main-guard.

Rear Guard.

Machine guns should remain in position until main body has deployed and come into action. While the guns are employed in holding off the enemy, the Section Officer with his scouts should be locating new positions on the flanks and probably a little further to the rear. The guns should be removed to these positions and press the enemy on the flanks.

1. As a rear guard will usually be required to hold positions with the minimum of men, a large proportion of machine guns should be allotted to them.
2. Experience of war has shown that well placed machine guns, supported by only a few Infantry, will frequently hold up an advance for long periods.
3. In occupying a rear guard position with machine guns, the

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ordinary principles of the defense apply, but the following points should be specially noted:

(a) Wide field of fire.

(b) Machine guns concealed in the least obvious places.

(c) Covered lines of retirement.

(d) Limbered wagons should be close up to facilitate a hasty retirement.

(e) Positions in rear, chosen before the machine guns retire from forward positions.

(f) Thus the retirement of the last gun can be covered. Pack transport is very useful.

VILLAGE FIGHTING.

1. As soon as the Infantry have made good one edge of a village, machine guns will be brought up in close support.

They will search windows, doorways, roofs, etc., likely to be held by the enemy.

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2. Machine guns will be used to command cross streets, etc., so as to guard against attack on the flanks or rear of the Infantry.
3. Machine guns should also be posted on the edges of the villages to prevent flank attacks.
4. When possible, machine guns should be pushed forward on the flanks, so as to command the exits of the village.
5. During village fighting every use should be made of windows, doors, etc., as machine gun positions.

N.B. For the more advanced work with the leading Infantry, Lewis Guns should be used in preference to machine guns.

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CHAPTER XIX

MACHINE GUN TRENCH WARFARE

DISTRIBUTION OF GUNS IN DEFENSIVE SECTOR.

A. **Preliminary.** Trenches exist and are organized primarily for defense.

Defensive Zone. *An area organized for defense* and not merely a succession of lines of trenches.

Trench System. All the field works included in a defense zone.

A Trench System usually consists of: —

1. Front Line Trench.
2. Support Trench, 40 to 100 yds. back, duplicating Front Line Trench.
3. Strong Points — in and behind support trench —

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number depends on tactical situation.

4. Subsidiary or Reserve Line — about 1000 yds. back — consists of Front Line trench, Support trench and Strong Points.

One Machine Gun Company of 16 guns attached to each infantry brigade.

Economy of Men. In trench warfare as in open warfare it is important to use minimum possible number of men for actual defense, in order either (a) to keep in reserve a force which can be used for the counter attack, or (b) to enable the offensive to be assumed elsewhere.

The tremendous stopping power of machine guns enables them to replace a large number of riflemen in actual defense.

B. **Belt of Fire.**

Most effective way of using ma-

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chine guns in defense is by creating and maintaining around the front to be defended a *cross belt of machine gun fire.* This is done by each gun firing to a flank on a line prearranged to coöperate with the guns on right and left, so that the lines of fire cross and are continuous around the entire front to be defended. This can only be achieved where there is coöperation between guns of a company and between guns of one company and those of companies on its flanks.

Coöperation is thus the essential principle of successful employment of machine guns in defense.

Machine guns are adapted for creating a belt of fire because of their:

1. Strength of construction.
2. Cooling system.
3. Fixed mountings.
4. Equipment permitting firing at any point in line within range at any time of day

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or night once that point has been fixed.

Lewis or other light guns are not adapted for this purpose because of:

1. Their lightness of construction.
2. Air cooling.
3. Rapidity of fire which does not permit of sustained fire.
4. No fixed platform or equipment as for machine guns.

It is rarely possible to arrange belt of fire to cover every foot of front and Lewis Guns are very useful to fill in gaps, *e.g.* cover sunken roads, ditches, old communication trenches. Coöperation must be arranged with them also.

C. Successive Belts of Machine Gun Fire.

If the enemy embarks on serious offensive operations against our line he will probably gain a temporary advantage at the outset

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— *i.e.* it must be expected that he will succeed in penetrating our line *in places.*

He will do this only because some of the machine guns forming our front belt of fire have been put out of action by preliminary bombardment. This always happens, but some parts of the front line, owing to difficulties of artillery observation and other causes, always remain intact. Machine guns concealed and provided with strong dug-outs in those places will survive and will begin the breaking down of the enemy offensive.

Therefore our defensive organization cannot be considered complete unless we have arranged for *several successive belts of machine gun fire;* by this means with reasonable luck, gaps in front belt will be spanned or partially spanned by succeeding belts in a sort of a echelon and we may hope to inflict on enemy such

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severe losses that he is forced to use up his reserve before he has gained substantial advantage, and then our counter offensive will probably be successful.

D. Machine Guns in Front Line Trenches.

As a general rule, machine guns are not placed in the front line. The reason of this is that the preliminary bombardment by the enemy usually completely destroys the front line and with it the machine guns, which form the backbone of the defense system. The front line is consequently normally manned by infantry and Lewis Automatic Rifles.

But machine guns are used in front line if —

1. Very stiff part of line, *e.g.*, Hooge, 1916.
2. Not sufficient Lewis Automatic Rifles.
3. Not sufficient infantry to hold

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line; *e.g.*, Courcelette, Sept., 1916, after attack by Canadians not enough men left to hold positions won in strength, 16 machine guns were placed in new front line to beat off counter attacks until reinforcements came up.

1. Here particularly machine guns assist in economizing infantry.
2. If at end of bombardment our front belt of machine gun fire is still continuous, enemy infantry attack will be a failure.
3. Some guns always knocked out.
4. (a) Remainder *begin* to break up attack.
   (b) Trenches covered by them remain in our hands and act as jumping off points for *lateral* counter attacks.

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(c) Also fire from them covers advance of counter attacks from rear to front.

5. Avoid using too many machine guns in front line trench; number can be reduced by —

(a) Careful selection of positions giving flanking fire.

(b) Good system of lateral communication. If this is not possible machine guns can be considered to cover only the ground which firer can actually see.

E. Machine Guns in Support Trench.

1. Provide secondary belt of fire and prevent further advance.
2. Protect flanks of portions of front line trench still remaining in our hands.
3. Being often unsuspected fre-

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quently escape destruction.

4. Enfilade front line trench if it is captured.
5. Sweep the communication trenches.

F. **Machine Guns in Strong Points.**

1. These should be occupied by machine guns to break up attack piercing lines in front.
2. Ground in front swept with cross fire.
3. Coöperate to make third belt of fire.
4. Concealment imperative. If strong point is registered by enemy artillery put machine guns short distance away in concealed position connected by sap to strong point.

G. **Machine Guns in Subsidiary Line.**

1. These lines are often incomplete but machine gun dug-

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outs and positions should be always in order.

2. Positions arranged to co-operate in belt of fire.
3. All guns not always in positions here but should be able to quickly occupy them.
4. Guns in this line may be used before and during enemy attack: —
   (a) For long range searching fire by map or otherwise, behind enemy lines.
   (b) To create a barrage by overhead fire, *e.g.*, taking of Regina Trench by Canadians, 100 machine guns used.
5. During quiet periods guns in reserve may be used for training purposes. Teams may rest.
6. These guns available to replace casualties.

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H. Conclusion.

For normal system of brigade holding trenches, machine guns of a company may be distributed about as follows: —

1. Support Trenches — 4 to 6 guns.
2. Strong Points — 4 to 6 guns.
3. Subsidiary Line and Brigade Reserve — 4 to 8 guns.

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CHAPTER XX

MACHINE GUN FIELD WORKS

GENERAL NOTES.

CHIEF FACTORS.

Time, Labor, Material, Concealment.
In open warfare concealment most important.

SEQUENCE OF WORK.

1. **Open emplacements.**
2. **Strong dug-outs.**
   They can be made by day and night.
   Should be placed behind parados.
   Must be made strong and have open emplacement close by.
3. **Splinter-proof look-out posts.**
   Object of — Ample protection must be provided for look-out men.
4. **Splinter-proof emplacements.**
   Used — (1) To support an attack.
   (2) To meet an attack, giving protection

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from enemy's covering fire.

(3) For protection against a bombing attack and small enemy shells.

5. **Alternative Emplacements.**
Have covered line of approach from other emplacement.

6. **Emplacements at end of a covered sap in front of our obstacles.**
Used — (1) To meet an attack by enfilading our own obstacles.
(2) Cover assault from our trenches.
(3) To escape the large shells directed at main trench.
(4) To direct fire onto ground which is dead from main works.

7. **Emplacements just in front of parapet.**
Uses — (1) To get enfilade fire.

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(2) To give concealment.
(3) To escape shells directed at own trench.

8. Concrete emplacements.
9. Dummy emplacements.
10. Central ammunition depot usually in Subsidiary Lines.

DUG-OUTS.

Can be made —

1. By tunneling under parapet or parados.
2. Building a shelter in a traverse under parapet, behind parados or in the side of a sap.

Points to be observed.

1. The overhead cover must be strong, with as much earth and timber on top as possible.
2. The roofing must be strongly supported and it is advisable to place feet under supports to prevent them from sinking too far into ground.

Guard against making weather shelters.

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The best method of getting protection is to dig down below the level of the fire step. Water question can be overcome by digging sump pit and by pumping off the water, while the sides and floor are revetted in order to resist the earth pressure and a thin two inch layer of concrete or corrugated metal is placed over revetment.

Machine Gun dug-outs should be made 5 ft. by 4 ft. and 4 ft. high. Should never be more than fifteen (15) paces from emplacement. If possible have two (2) dug-outs to every gun.

Recess should be made in the side of dug-outs for machine gun spare parts and ammunition boxes. Recesses should be made in emplacement for ammunition.

EMPLACEMENTS.

Setting of them.

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1. Lay of ground.
2. Zone to be covered.
3. Position of enemy trenches.

Concealment of emplacement.

They must be made to look like the remainder of trench. Loopholes must be concealed from the view of enemy.

Hints regarding concealment of loopholes.

1. Sandbags filled with straw or grass which can be easily pulled out. Steel plate should be placed behind sandbags.
2. A light hinged trap door in front of loophole.
3. Close mesh wire over loophole at angle of parapet and over this throw rubbish to conceal.
4. A board with earth thrown over it and placed over loophole.

Concealment from enemy patrols.

Care must be taken that machine guns in forward positions are well concealed.

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Concealment from air craft.

Take precautions that emplacements and saps leading to them are not discovered by air craft. Overhead cover should be used.

Protection.

Protections must be provided for against shells and bombs.

Requirements.

(1) Both open and bomb proof emplacements require 6½ ft. of earth in front.

(2) Open emplacements with loopholes require 12 inches of earth over loophole.

(3) Splinterproof head cover is two layers of wooden bulks bound together, with 20 inches of earth on top and strongly supported.

(4) A detonating layer of rubble (broken brick, etc.) will increase the strength. An air space left below the detonating layer will take the concussion of the explosion.

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Corrugated iron will prevent water leaking through.

(5) Emplacements should be revetted.

Dimensions of emplacements.

Open Emplacement 4 ft. square. The platform must be from 1 ft. 6 in. to 2 ft. below height over which gun is to fire.

Minimum Dimension of Emplacement with Head Cover — 5 ft. long to enable number 1 to sit or stand behind gun. 4 ft. wide to give room for number 2.

The clearance between the bottom of the loophole and the overhead cover must not be less than 2 ft. The loophole not less than 9 in. in height.

Material.

Loophole box complete with battens. 2 in. planks used. 1 required.

Sleepers for roofing. 9″ x 4″ x 6′— 15 required.

Posts. 7″ x 4″ x 4′8″— 6 required.

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Corrugated Iron. 2 Sheets required.
Nails (6″) — 20 required.
Sandbags — 100 required.
Wire netting.

Thin parapets should be protected by 18″ of sandbags packed with broken bricks, etc.

DEFINITION OF TERMS USED IN MACHINE GUN FIELD WORKS.

Bomb proof. A shelter proof against light shells.

Casemate. A shell proof chamber constructed for the accommodation of a garrison.

Dead ground. Ground which cannot be covered by fire.

Epaulment. Small parapet to give cover to a gun and detachment in action.

Fascine. A long bundle of brush wood used for revetting.

Reëntrant. A valley or depression running into a main feature.

Sap. A trench formed by constantly extending the end towards the enemy.

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Splinter proof. A shelter proof against shell splinters.

SLOPES.

Exterior Slope. The outside slope of a parapet extending downwards from the superior slope.

Interior Slope. The inside slope of a parapet extending from the crest to the Banquette.

Superior Slope. The top of a parapet immediately forward from the crest.

Crest. The intersection of the superior and interior slopes of a parapet.

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CHAPTER XXI

ORGANIZATION AND DUTIES IN TRENCHES

ORGANIZATION.

1. All positions numbered — right to left.
2. Order board in dug-out and emplacement.
3. In emplacement,
   (1) Range Card.
   (2) Limits of traverse in cross belt of fire.
   (3) Limits of safety for traversing.
   (4) Anti-gas apparatus.
   (5) Grenades.
   (6) Periscope.
   (7) Very pistol and lights.
   (8) Half of the ammunition of gun position.
4. In dug-out,
   (1) Trench store card.
   (2) Half of the ammunition of gun position.

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(3) Clinometer.

5. At **alternative emplacement,**

(1) Range Card.

(2 If possible a few filled belts.

USE OF POSITIONS.

Distribution of Crew.

1. *Normally.*

(a) At Central Ammunition Depot — 2.

(b) On guard — 1 by day, 2 by night.

(c) In dug-out — remainder.

2. *During Bombardment.*

Divide numbers of crew not at Central Ammunition Depot or on guard, between two dug-outs.

After bombardment in contemplation of attack and at "Stand-to"—

(a) At Central Ammunition Depot — 2.

(b) With gun — 2.

(c) In dug-out — 2.

(d) On flanks armed with grenades — 2.

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Location of Gun.

1. *Normally.*
   (a) If battle emplacement, mounted on tripod, day and night.
   (b) If no battle emplacement, in dug-out during day; mounted at night as soon as darkness ensures that enemy cannot observe.
2. *During Bombardment.*
   (a) If battle emplacement. Gun with rope attached in dug-out, unless enemy very close, when gun is left mounted in emplacement with rope attached.
   (b) If no battle emplacement. Gun with rope attached in dug-out.
3. *During Gas Attack.*
   (1) Mount gun and keep firing. Reasons for,—
      (a) Beats off enemy attack.
      (b) Keeps up morale of own troops.

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Reasons against,—
Gas corrodes gun and ammunition and consequently gun stops in short time.

(2) Or wrap in blanket that has been sprayed with anti-gas solution and place in dug-out, unless enemy very close. In latter case leave mounted and throw blanket over it.

4. *Firing from position.*
   (1) Do not fire from gun position if enemy can detect position, unless attacked.
   (2) If emplacement in front line or supports has been fired from, move.
   (3) Fire from dummy emplacements occasionally.

TRENCH ROUTINE.

1. Sentries — 1 by day, 2 by night.
2. "Stand-to"—
3. One hour after "Stand-down" in the morning guns are overhauled

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and cleaned. Schedule should be drawn up by Section Officer showing time of cleaning of each gun. No two guns to be cleaned at same time.

4. Ammunition to be gone over daily, and in damp weather, rounds turned in belts daily. Wet belts to be changed with Central Depot for dry ones.
5. Grenades examined from time to time.

Every Machine gunner must know:

1. Exact line of own and enemy's trenches.
2. Position of listening posts.
3. Alternative positions.
4. Limits of traverse in belt of fire.
5. Distribution of material and personnel of gun crew.
6. Care and employment of anti-gas appliances.
7. Route from gun position to Section Officer's headquarters, stretcher bearers, nearest telephone, Central Ammunition

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Depot, position of other guns in vicinity and ration dump.

8. Rules for sanitation.
9. Rules for fires and cooking.

Ammunition.

(A) At gun position 8 full belts and 4000 rounds in unopened S. A. A. boxes.

(B) At Central Ammunition Depot 8 full belts and 4000 rounds in unopened S. A. A. boxes.

N. B. Opened S. A. A. boxes in damp places should be replaced by unopened.

Machine Gun Company Commander.

(1) Sees that field of fire of each gun is correctly marked on trench maps.

(2) Visits sections daily and occasionally at night.

(3) Establishes personal relations with Infantry, Artillery and Engineers.

(4) Keeps in touch with O. C. Brigade *re* plans.

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Second in Command.

(1) Administration.
(2) Rations.

Section Officer.

(1) Keeps second in command informed of requirements of section *re material*, personnel, ammunition, etc.
(2) *Returns*
  (a) Intelligence Report.
  (b) Casualty Report.
  (c) *Re* Reliefs completed.
  (d) Firing done and work done.
(3) Issues orders to section, showing hours of work, "Stand-to" rest, time for cleaning guns, etc.
(4) *Inspections.*
  (a) *Daily.*
    (1) Arms and Equipment.
    (2) Iron Rations.
    (3) Gas Helmets.
    (4) Field Dressings.
    (5) Guns, ammunition and spare parts.

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(6) Dug-outs, emplacements and latrines.

(b) Before and after tour trenches.

(1) Feet.

(2) Boots.

(3) Water bottles.

(5) *Coöperation with local Infantry and Lewis Gunners.*

Section Sergeant.

(1) Keeps duty roster.

(2) Responsible for condition of all arms.

(3) Enforces rules as to cleanliness, etc.

Corporals.

(1) Responsible for ration carrying parties, drawing materials and supplies.

(2) Responsible for condition of ammunition and belts.

Number 1 of Gun Crew.— Usually Lance-Corporal. Has general control and is responsible for equipment and discipline of crew.

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CHAPTER XXII

TAKING OVER TRENCHES

There are two distinct kinds of reliefs:

1. Those of troops who are not in own company.
2. Those of troops in own company.

In taking over, it is absolutely essential that the Company Commander, accompanied, if possible, by one officer from each Section, go very thoroughly over the lines of defense. Where possible it is advisable that each gun commander should have an opportunity of acquainting himself with his frontage before the relief takes place.

The important points to be noted in this preliminary tour of inspection are.—

1. Ground covered by each gun.
2. If there is danger of enfilading own trenches.
3. If position has been fired from.

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4. If it is thought to be located by enemy.
5. If it has been registered by enemy's artillery.
6. Its strength.
7. Exact location and amount of S. A. A.
8. Alternative positions.
9. Dug-outs.
10. Water and fuel supply.
11. Details of frontage, dead ground, and any natural contours that would assist in the event of an advance.

Information to be obtained regarding *approach from billets are:* —

1. Limbers.
   (a) Route to be used by limbers and the danger points on that route.
   (b) Limit of approach to Front Line.
   (c) Safest place to unload guns and rations.
   (d) Alternative routes in case first route is being shelled.

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2. **Men in Parties.**
   (a) Route in use for present relief and danger points.
   (b) Points where route is under observation.

3. **Not More Than Two Men.**
   This would be emergency route and details can seldom be given as to its safety. Very often path used for several months, then one or two men sniped, then not another casualty.

4. **Ration Routes.**
   These include the location of any paths, ditches or fences used by day or night in addition to safe communication trench route.

Relief Proper.

When the above details have been secured, the ingoing Company Commander submits his plans for time and route of relief, improvements and changes in gun positions, etc., to Brigadier. Then issues detailed orders to Section

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Commander. To avoid mistakes, copy of orders *re* relief issued by ingoing Company Commander should go to out-coming Company Commander and vice versa.

Company Commander Makes Arrangements for —

1. Transports.
2. Dumping grounds for ammunition and rations.
3. Carrying party from infantry.
4. Rendezvous where guides will meet in-going crews. Each position should have separate guides. Care should be taken that —
   (a) Guide arrives at rendezvous before crew he is meeting.
   (b) Guide very thoroughly knows route to gun position.
   (c) Position of rendezvous is indicated in orders beyond any doubt, *e.g.*, "Ration Dump" or "Ration

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Farm" not sufficient. Exact map location should be given.

(d) Rendezvous is not cross roads, Engineers' Dump or other place that enemy is likely to have registered and shell at night.

5. Man in command of each crew should before leaving billet be informed of —

(a) Number of, location of, and particulars of position he is to take over.

(b) The name of the guide that will meet the crew.

Approach.

It is probable that limbers will take a separate route to arrive at rendezvous. It has proved to advantage that one man from each Gun accompany limber and that on arrival at rendezvous the

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equipment for each crew be put in separate lots, in a prearranged order and that limber or limbers be dismissed at once.

The Section should never arrive before limber for obvious reasons.

On the arrival of Section each man will fall in on his own marker, the particular part of the equipment he will carry having been previously detailed to him. If the guides have not already arrived the Section should at once open out, each N. C. O. keeping in touch with his crew, and take the best cover available; this applies no matter how quiet the night.

Rations.

It should always be arranged that one man at least remains with transport to act as cook. He should be supplied with a list of each gun crew. Rations should be divided into guns and placed into separate bags with the mail for each gun crew. It is also im-

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portant that the rum ration be divided in the same way. These bags must be distinctly marked with the gun number. When rations have been brought up in daylight this has been marked with indelible pencil; for night work, when it was not possible or advisable to use a torch, a number of knots corresponding to the number of the gun have been tied in the string fastening of the sand bag. This system enables rations to be given out with very little delay and is far more satisfactory than any division made after rations reach the Front Line. When possible, Machine Gun Ration Parties should be back in their several positions before the Battalion Ration Parties have started out. Fuel must be divided in the same way as the rum ration.

During the rainy season, gun crew should send out their wet socks with Ration Party. These socks

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can be returned dry with next day's rations.

Relief with Section of Own Company.

The first relief will be carried out exactly as above with the following exceptions: —

It has proven of great assistance and advantage, when working with a regular system of reliefs on a given frontage, that the Section in the trenches leave its tripods and all loaded belts in belt boxes for the in-coming section.

The tripods and an equal number of loaded belts must be sent by relieving section's machine gun limber to the billets of the out-coming Section. It is of the greatest importance that these are at the billets *before* the arrival of the machine gun section. It must never be overlooked that each Section might be called into action at any moment, it therefore should be a point of honor with each Section that all equipment

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turned over is in the best working order.

On Arrival at Trenches.

1. *Section Officer* proceeds to out-going Officer's headquarters.
   (1) Out-going Officer should have ready —
      (a) Receipt for all stores, ready to be signed. Copy of same for in-coming Officer.
      (b) Written report on gun positions, work done, firing done, etc., for in-coming Officer.
   (2) If in-coming Officer has not been over position; out-going Officer conducts him on inspection.
   (3) When each crew going out has reported to Sergeant that relief is complete, Sergeant reports to out-going Officer. Both in-coming and out-going Officers wire Officers Com-

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manding "Relief complete" in code previously arranged.

2. *Crews* proceed to positions via Officer's Headquarters if possible, reporting there on way in.

Commander of each gun should have ready receipt for all Stores at gun position ready to be signed, with duplicate for in-coming Gun Commander. He then shows Gun Commander over position.

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CHAPTER XXIII

THE ATTACK

The difference between **Trench** and **Open Warfare.**

1. Each side has a more or less intimate knowledge of the disposition of the other side's guns, etc.
2. Can make attack at leisure and rehearse it.
3. Attack can be made from assaulting distance like the final phase in Open Warfare.
4. Trench attack is more mechanical and the smallest details have to be looked into with great care.

CONSIDERATIONS.

1. A well thought out scheme.
2. Close coöperation between all arms.
3. Clearly defined objective.
4. Correct anticipation of enemy's defense scheme.

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5. Provision for protection in case of failure.

GENERAL PRINCIPLES.

1. Importance of constructive policy.
2. Issue of orders.
3. Coöperation with infantry.
4. Distribution of guns.
5. Ammunition and transport.

RECONNAISSANCE NECESSARY.

1. By observation.
2. Aëroplane and trench maps.

THINGS TO LOOK FOR.

1. Points from which enemy's machine gun fire is to be anticipated.
2. Points from which machine gun fire can be directed with effect.
3. Points in enemy's line which can be marked down as suitable for our own guns when position is won in order to stop counter attacks by belt of fire.
4. To facilitate orders note the numbers and names of trenches.

ALLOTMENT OF POSITIONS.

1. Machine Gun Company Commander

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will allot those from which guns can best support infantry.

2. Send out Lewis guns to shell holes or along saps to support infantry over the parapet. These guns will follow up with first wave of attacking infantry.

Machine guns must be always ready to dash to the aid of an unprotected flank.

GUNS IN RESERVE.

Duties — 1. Bring overhead fire to bear on enemy.
2. To cover a retirement.
3. Search ground in rear of enemy.
4. Move into those positions vacated by machine guns which have gone forward.

TRANSPORT AND AMMUNITION.

1. A dump system should be adopted, and a Section Depot.
2. Make provision for a further supply.
3. Select route.

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4. Get Engineers to make bridges across shell holes.
5. Use pack animals as far as possible.

THE END

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